Biophysical Setting Classification and Mapping

Biophysical settings (BpS) are the primary landscape delineations for determination of the natural fire regime and fire regime condition class (FRCC). These settings incorporate both classification (taxonomic) and map unit concepts. Ecosystems can be classified based on a single attribute—vegetation, soils, geomorphology, etc., and they can also be classified based on integrated attributes, such as ecological types (Winthers et al. 2004), ecological sites (NRCS 2003), or ecological systems (Comer at al. 2003). The taxonomic units of these classifications can be considered **biophysical classes.** When these classes are mapped in organized, repeating units, **biophysical units** result.

These units are land delineations based on geographic area, physical setting, and vegetation community that can occupy the setting. Physical characteristics include climate, geology, geomorphology, and soils. Vegetation includes native species and successional stages found under our best understanding of the historic range of variation, including disturbances. In addition to these attributes, each biophysical setting also has distinct ecological processes associated with it—notably fire frequency, severity, and size—and hence provides a cogent, robust concept for displaying fire regime condition class.

With this document version, "biophysical settings (BpS)" replaces "potential natural vegetation groups (PNVGs)" in FRCC nomenclature. This change has been incorporated to reduce confusion and increase the clarity of the ecosystem concept used in FRCC, and to demonstrate the versatility of the FRCC process to quantify ecological change. *Users should note for all practical, applied purposes these terms refer to the same thing.*

Scale and Resolution

Ecosystems can occur at any scale, from site to landscape to region. The emphasis in FRCC is on mid-scale landscapes, because this is broad enough to display the characteristic patterns of a fire regime—the mix of fire severity, frequency, and fire pattern across the land. (Note the concept works with other disturbances as well—wind, soil movement, etc.—but our focus is on fire here.) The selection of appropriate landscape size to describe the BpS is important. If the area is too small, a false picture of fire severity, frequency, and size emerges, and mistakes in planning will inevitably follow. If the area is too broad, we lose the ability to discern small changes in FRCC. Fifth- or sixth-field watersheds (25,000-100,000 acres) can be used as a logical assessment area for FRCC evaluation. Because watersheds or similarly-sized analysis areas often encompass a variety of distinct ecosystems, these areas must be then subdivided into strata of relatively uniform BpS. Landtype associations (LTAs), where defined, may be a preferable alternative (Winthers et al. 2004). Landscapes can be defined locally, but great care and consistency should go into this effort, since landscape selection strongly influences FRCC determinations—improperly defined landscapes are likely to lead to poor management decisions or reduced ability to monitor accomplishments. Expert teams serving a region or sub-region can develop consistent landscape definitions for use by all those using FRCC.

As a practical matter, FRCC determinations can also be made at the local scale (tens to hundreds of acres rather than thousands), but to facilitate project planning and reporting, not substitute for landscape FRCC determinations. Local FRCC assessments should always be tiered to broader landscape-scale FRCC determinations.

Vegetation as a Proxy for Biophysical Setting

Although biophysical settings represent the collective, integrated attributes of an environment, we use vegetation classes as a **proxy** to describe them. The BpS is typically identified by vegetation series or zones, but *it should be clearly understood they are a practical surrogate for the BpS, for the purpose of assessing fire regime and fuel conditions, and not a concise classification of*

vegetation or ecologically-integrated map units. These vegetation series or zones are indicators for the mix of fire severity, frequency, and size across the landscape. For example, grand fir is often associated with a mixed severity fire regime, and Ponderosa pine with a frequent, low-intensity fire regime.

Both forest and rangeland vegetation can be defined in existing, potential, and historical terms. Existing vegetation is the plant cover, or floristic composition and vegetation structure, occurring at a given location at the current time (Brohman and Bryant 2004). It is expressed in the current vegetation-fuel classes (A,B,C,D,E, and U) of the FRCC determination.

Potential natural vegetation (PNV) is the vegetation that would become established if all successional sequences were completed without human interference under present climatic and edaphic conditions (Winthers et al. 2004, Brohman and Bryant 2004). In a modern context, potential natural vegetation emphasizes land capability, and not a climax community concept. In other words, potential natural vegetation is the environmental expression of the land given natural ecological processes (Hann et al. 1997, Hessburg et al. 1999). PNV is the vegetation expression of the BpS.

Historical vegetation is the vegetation that developed during a reference period prior to Euro-American settlement, and was affected by Native American burning. The time of Euro-American settlement varies throughout the United States, from the early 1600s in coastal Virginia and New England to the late 1700s in the Appalachians to the late 1800s throughout much of the Northern Rockies and the Pacific Northwest. For the purposes of describing historical vegetation, the length of the reference period varies; e.g., for the Interior Columbia Basin assessment, time ranges up to 400 years prior to a settlement date of 1850 were used (i.e., 1450-1850) (Quigley and Arbelbide 1997). As used in FRCC determinations, the PNV is very similar to the historical vegetation.

More specifically, in identifying BpS for FRCC determinations, we use potential natural vegetation (PNV) as used by Kuchler (1964) and in the Natural Resource Conservation Service for ecological site determinations (NRCS 2003). This definition of PNV incorporates disturbance. A common example throughout much of the west is the Ponderosa Pine-Douglas-fir Biophysical Setting. This setting includes the vegetation that developed within an historical fire regime of frequent, low-intensity fires. If the development of successional stages is constrained only by climate (and not disturbance), these areas are often classified as grand fir or Douglas-fir. These species will ultimately dominate the overstory in the absence of disturbance (fire). Kuchler (1964) defined potential natural vegetation (PNV) as the plant communities that would become established without modern human interference with current environment & biota. This includes anthropogenic burning, lightning fire, & other non-mgt disturbances.

Use of disturbance in defining the vegetation component of the BpS is critical for FRCC, since condition class is an estimate of departure from the historical range of variation in successional stages, fire frequency, and fire severity across a landscape. For use in FRCC the BpS characteristics should normally be narrow enough to limit the variation to one natural or historical fire regime and one vegetation series at landscape scale.

Using an historical range of variation prior to Euro-American settlement to describe the vegetation of the BpS is often criticized because this period was cooler than today's climate. Where data and understanding of the mix of successional stages in today's climate (but without current human interference) are available, these should be used. (This range under the current climatic regime is sometimes referred to as the natural range of variation.) In many cases this information is lacking, however. The historical range of variation usually offers our best understanding of functioning landscapes with the full array of ecosystem structure, composition, and processes. In short, this is what we know was functioning and sustainable—and FRCC estimates our departure from that working system.

Many existing classifications of potential vegetation are in use. Although somewhat simplified in presentation, Table x1 is useful in comparing and understanding commonly used approaches to classifying potential vegetation. These fall into two basic groups: 1) those describing potential vegetation without natural disturbances (i.e., constrained only by climate); and 2) those specifically incorporating disturbance (fire, wind, soil movement, etc.) In delineating BpS, it is not necessary to disregard potential vegetation classifications that do not currently incorporate disturbance. In most cases, the two basic groups of classification are strongly related. For those not incorporating disturbance, however, it will be necessary to crosswalk them to those that do. We advise these crosswalks be developed as a consistent product by regional or sub-regional expert teams and made available to users.

Biophysical Settings (BpS) Summary

- **BpS is the primary landscape delineation for FRCC, and incorporates both classification and map unit concepts**
- **BpS can occur at any scale; emphasis is on mid-scale landscapes in FRCC**
- **Vegetation is used as the environmental expression of the land's capability—a proxy for describing the biophysical setting**
- **FRCC uses a potential vegetation concept incorporating disturbance**
- **Incorporating disturbance is critical, because FRCC is an estimate of the departure from the historical range of disturbance (fire regime).**
- **We recognize the historical range often developed under a different climatic regime. Where data are available, use the current (natural) range of variation given lack of human interference.**
- **Rely on regional and subregional expert teams to define landscapes and biophysical settings for your area**

Table x1. This table shows a comparison of types of the vegetation associated with Biophysical Settings (BpS). These classifications can be divided into two groups: those described with and those without the natural or historical disturbance regime.

Vegetation Classification Approach	Classification Examples	Reference
Without Natural or Historical Disturbance (Constrained Only by Climate)	Habitat Type and Climax Plant Association	Daubenmire 1968
	Potential Vegetation Type	Keane and others 1986
	Potential Natural Vegetation	Winthers et al. 2004
With Natural or Historical Disturbance	Kuchler Potential Natural Vegetation	Kuchler 1964
	Ecological Site Classification	USDA Natural Resource Conservation Service 2003
	Ecological Systems	Comer et al. 2003

References

Brohman, R., and L.Bryant. 2004. Existing Vegetation Classification and Mapping Technical Guide. USDA Forest Service, Washington Office, Ecosystem Management Coordination Staff.

Comer, P., D. Faber-Langendoen, R. Evans, S. Gawler, C. Josse, G. Kittel, S. Menard, M. Pyne, M. Reid, K. Schulz, K. Snow, and J. Teague. 2003. *Ecological Systems of the United States: A Working Classification of U.S. Terrestrial Systems.* NatureServe, Arlington, Virginia. Available online at: http://www.natureserve.org/publications/usEcologicalsystems.jsp

Daubenmire, RF, 1968. Plant communities: A textbook of plant synecology. Harper and Row. NY. 300 pp.

Keane and others 1986

Kuchler, A.W., 1964, The potential natural vegetation of the conterminous United States: New York, American Geographical Society, Special Publication No. 36, scale 1:3,168,000.

NRCS (Natural Resources Conservation Service) 2003. National range and pasture handbook. Washington, DC: USDA Nat. Res. Conserv. Serv.

Quigley, T.M. and S.J. Arbelbide, eds. 1997. An assessment of ecosystem components in the interior Columbia basin and portions of the Klamath and Great Basins: vol. 2. Gen. Tech. Rep. PNW-GTR-405. Portland, OR: USDA For. Serv. Pac. Northwest Res. Sta. 4 vol.

Winthers, E. , Fallon, D. , Haglund, J. , DeMeo, T. , Tart, D. , Ferwerda, M. , Robertson, G. Gallegos, A. , Rorick, A. , Cleland, D. T. , Robbie, W. and Shadis, D. , 2004. Terrestrial Ecological Unit Inventory Technical Guide. USDA Forest Service, Washington Office – Ecosystem Management Coordination Staff, 125 pp.